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METHOD FOR BLOWING A FINE CHARCOAL POWDER

[Bifun Tan Fukikomi Hoho]

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Specification

1. Title of the invention

Method for blowing a fine charcoal powder

2. Patent Claim

1. A method for blowing a fine charcoal powder with the following characteristics: In a method for blowing a fine charcoal powder into a shaft furnace, an air purge mechanism for a fine charcoal powder adhered to the nozzle interior is configured on a nozzle for blowing the fine charcoal powder, whereas the temperature in front of a tuyere is measured, and in a case where the obtained measurement result satisfies a certain condition related to the quantity of the fine charcoal powder adhered to the nozzle interior, the aforementioned air purge mechanism is driven.

3. Detailed explanation of the invention

The present invention concerns a method for blowing a fine charcoal powder into a shaft furnace from a tuyere via a blow nozzle, more specifically, a method for preventing the congestion of said blow nozzle with the fine charcoal powder.

Coke alone has, in the prior art, been used as a fuel for shaft furnaces, but thanks to the advancement of the shaft furnace technology, attempts have been made to blow a heavy oil, as an auxiliary fuel, into the shaft furnace from the tuyere, and more

[1] Numbers in the margin indicate pagination in the foreign text.

recently, a method wherein a fine charcoal powder is blown from the tuyere in place of the aforementioned heavy oil has been implemented for practical purposes in reflection of energy shortage.

This method for blowing a fine charcoal powder from a tuyere is executed by attaching a blow nozzle to the tuyere in such a way that the outlet of the former will be positioned at the distal end of the tuyere and by blowing the fine charcoal powder via said blow nozzle, but in a case where this method is implemented, the fine charcoal powder becomes heated and then adhered to the inner wall of the blow nozzle at its distal end, as a result of which the blow nozzle becomes congested, and since the flow rate of the fine charcoal powder blown from the congested tuyere decreases, the rates for blowing fine charcoal powders from the individual tuyeres become heterogeneous. Such an inconvenience must be avoided from the standpoint of ensuring a stable shaft furnace operation.

Attempts have been made to avoid such an inconvenience in the prior art by temporarily halting the feeding of the fine charcoal powder into the blow nozzle and by feeding compressed air instead for the purpose of purging the interior of the blow nozzle. No method wherein the blow nozzle interior is purged in a state where the fine charcoal powder is being concomitantly blown at a constant temperature in front of the tuyere, however, has been developed.

In a case where the aforementioned blow nozzle becomes characterized by a congested state, the flow rate of the fine charcoal powder blown from said tuyere decreases, as has been /2

mentioned above, and it has empirically been discovered that the temperature in front of the tuyere also becomes elevated. Figure 1 is a graph,which shows the relationship between the temperature in front of the tuyere and the fine charcoal powder flow rate, according to which a constant relationship can be acknowledged between the two.

The objective of the present invention, which has been completed based on the foregoing insight, is to stabilize an operation for blowing the fine charcoal powder into the shaft furnace by measuring the temperature in front of the tuyere for detecting the fine charcoal powder adhesion state of the blow nozzle interior and by assuredly preventing the congestion of the blow nozzle based on the obtained detection results.

The method of the present invention for blowing a fine charcoal powder is characterized as follows: In a method for blowing a fine charcoal powder into a shaft furnace, an air purge mechanism for a fine charcoal powder adhered to the nozzle interior is configured on a nozzle for blowing the fine charcoal powder, whereas the temperature in front of a tuyere is measured, and in a case where the obtained measurement result satisfies a certain condition related to the quantity of the fine charcoal

powder adhered to the nozzle interior, the aforementioned air purge mechanism is driven.

In the following, the present invention will be explained in detail with reference to figures which instantiate its application examples. Figure 2 is a diagram,which shows a model wise cross-sectional view of the vicinity of the shaft furnace tuyere of the method of the present invention, whereas Figure 3 is a diagram which shows a magnified view of the main components of the same.

(1) is a shaft furnace characterized by a structure wherein the inner plane of the iron skin (1a) is lined with the brick (1b), whereas a pig iron is manufactured by loading iron ores, coke, limestone, etc. into its interior. A hot air circulation tube (not shown in the figure) which stems from a hot air furnace (not shown in the figure) is configured around said shaft furnace (1) in a cyclic fashion, and said hot air circulation tube, furthermore, is connected to each of the tuyeres (2) configured, at an equal interval, around the inner circumference of the lower portion of said shaft furnace (1) via the air transmission assistance tubes (3). Air heated at a high temperature within the hot air furnace, furthermore, is designed to be blown homogeneously into the shaft furnace (1), along its circumferential direction, from the tuyeres (2) via said hot air circulation tube.

Attached to the portion of the powering mechanism (3) that affords an unobstructed view of each air transmission assistance tube (3) (the bent portion of the air transmission assistance tube

(3) in the figure) is the thermometer (4) for the purpose of measuring the temperature in front of the tuyere, whereas signals on the measurement values of said thermometer (4) are inputted into the controller (5).

(6) is a blow nozzle which is attached to each tuyere (2) in such a way that the distal outlet (6a) thereof will be positioned at the distal end of said tuyere (2), whereas a fine charcoal powder which has been transmitted through said blow nozzle (6) becomes blown into the shaft furnace (1) together with the high-temperature air blown into the distal end of the tuyere (2), as has been mentioned above.

As Figure 3 shows, the heated fine charcoal powder A tends to become adhered to the inner wall of the blow nozzle (6) near its distal end, whereas an air purge mechanism for blowing away said fine charcoal powder A with compressed air, namely the ejector (7), is attached to the blow nozzle (6) in such a way that the distal outlet (7a) of the former will be positioned at the distal end of the latter. The electromagnetic valve (8), furthermore, is attached to an intermediate position of the ejector (7), whereas said electromagnetic valve (8) is designed to be ON/OFF-controlled by the output signals of the aforementioned controller (5). In other words, the controller (5) engages in a control routine whereby the measurement value of the aforementioned thermometer (4) is compared with a preliminarily designated standard value and whereby the aforementioned electromagnetic valve (8) is opened in a case where the former is higher than the latter or whereby the

aforementioned electromagnetic valve (8) is closed in a case where the opposite holds.

In a case where the fine charcoal powder is blown into the shaft furnace (1), which is characterized by the aforementioned constitution in the vicinity of the tuyeres (2), and where the fine charcoal powder becomes heated and then adhered to the inner wall of the blow nozzle (6) in the vicinity of its distal end, the distal end of said blow nozzle (6) becomes characterized by a congested state, as a result of which the flow rate of the blown fine charcoal powder decreases. As the flow rate of the blown fine charcoal powder thus decreases, furthermore, the temperature in front of the tuyere becomes elevated, as has been explained with reference to Figure 1, and therefore, the congestion state of the blow nozzle (6) can be grasped by measuring said temperature in front of the tuyere by using the thermometer (4). The electromagnetic valve (8) is therefore ON/OFF-controlled based on the obtained measurement value, and in a case where the aforementioned blow nozzle (6) has become congested, compressed air is blown into the distal end of the blow nozzle (6) by the ejector (7) for the purpose of blowing away the fine charcoal powder A, which has, as mentioned above, been adhered to the latter, as a result of which the interior of the blow nozzle (6) becomes purged with air. Incidentally, it goes without saying that it is easier to measure the temperature in front of the tuyere, as in the present invention, than to measure the flow rate of the fine charcoal powder blown from the tuyere.

Next, an application example of the method of the present invention will be explained. Figure 4 is a graph, which shows the comparison of the respective temperatures in front of the tuyeres of the method (indicated by the dotted curve in the figure) and the method of the prior art (indicated by the unbroken curve in the figure). It can be inferred from this figure that, in comparison with the method of the prior art, the variation of the temperature in front of the tuyere is minimized in the method of the present invention, which accordingly suggests a minimal

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variation of the flow rate of the fine charcoal powder blown into the shaft furnace from the tuyere, and thus, the excellent effects of the method of the present invention were confirmed.

As the foregoing detailed explanations have demonstrated, as far as the method of the present invention for blowing a fine charcoal powder into a shaft furnace is concerned, the quantity of the fine charcoal powder adhered to the interior of the blow nozzle is detected based on the temperature in front of the tuyere, and in a case where it exceeds a certain threshold, compressed air is blown into the blow nozzle, as a result of which the congestion of the blow nozzle can assuredly be prevented by this air purge operation, and the quantity of the fine charcoal powder blown from the tuyere can be homogenized. The present invention therefore provides a useful mechanism, which contributes to the realization of a stable shaft furnace operation.

4. Brief explanation of the figures

Figure 1 is a graph which shows the relationship between the temperature in front of the tuyere and fine charcoal powder temperature, whereas Figure 2 is a diagram which shows a modelwise cross-sectional view of the vicinity of the shaft furnace tuyere of the method of the present invention, whereas Figure 3 is a diagram which shows a magnified view of the main components of the same, whereas Figure 4 is a graph which shows the effects of the method of the present invention.

(1): Shaft furnace; (2): Tuyere; (4): Thermometer; (6): Blow nozzle; (7): Ejector.

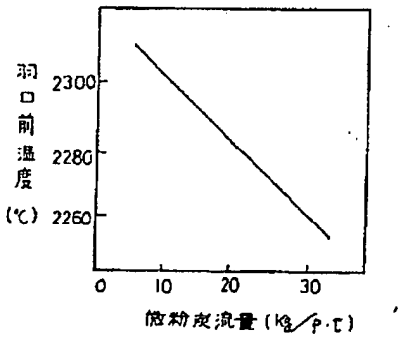

Figure 1

[(1): Temperature in front of the tuyere; (2): Fine charcoal powder flow rate]

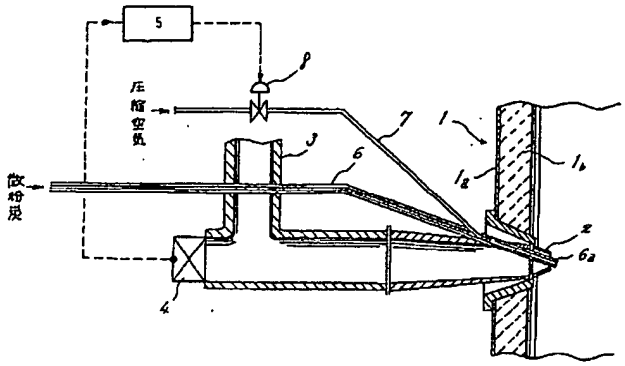

Figure 2

[(1): Fine charcoal powder; (2): Compressed air]

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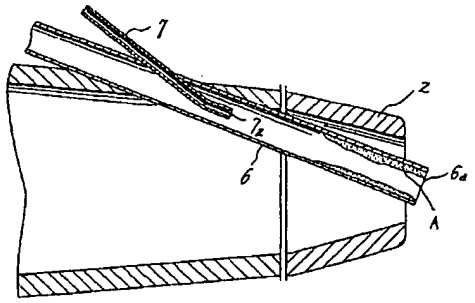

Figure 3

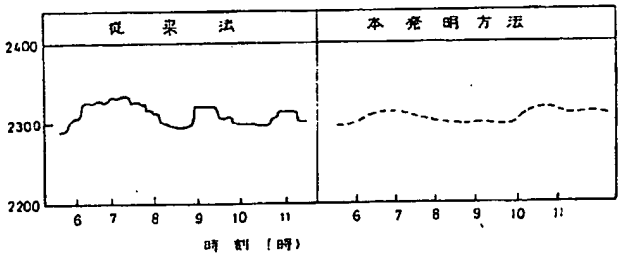

Figure 4

[(1): Temperature in front of the tuyere; (2): Time (hours); (3): Method of the prior art; (4): Method of the present invention]

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TITLE: BLOWING METH D F PULVERIZED COAL

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ASSIGNEE-INFORMATION:

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APPL-DATE: July 23, 1982

INT-CL (IPC): C21B007/00

US-CL-CURRENT: 75/460

ABSTRACT:

PURPOSE: To stabilize blowing of pulverized coal into a blast furnace by providing an air purging means for the pulverized coal sticking in a nozzle to the nozzle, measuring the temp. in front of a tuyere and driving the air purging means in accordance with the result of the measurement.

CONSTITUTION: The inside wall in the forward end of a nozzle 6 for bl wing pulverized coal is vulnerable to sticking of the pulverized coal. An ej ctor 7 is provided with the outlet at the forward end, which is located in the forward end of the nozzle 6. A thermometer 4 for measuring the temp. of the tuyere 2 of a branch pipe 3 for ventilation is provided in the part of the pipe 3 where the tuyere 2 is visible from the thermometer. A solenoid valve 8 is m unt d in the midway of an ej ct r 7. A contr l device 5 c mpares th valu m asur d with the therm m t r 4 and a pr s t reference value, and when th f rmer is higher than th latter, the valve 8 is open d to eject th c mpress d air from the eject r 7. Th r f re, the pulverized c al sticking to

the inside wall in th f rward end part f th nozzle 7 is rem ved.

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（全 4 頁）

⑤4微粉炭吹込み方法

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明　細　書

1. 発明の名称　　微粉炭吹込み方法

2. 特許請求の範囲

1. 高炉内へ微粉炭を吹込む方法において、微粉炭吹込み用ノズルにノズル内付着微粉炭のエアパージ手段を設けておく一方、羽口前温度を計測し、この計測結果がノズル内付着微粉炭量と関連づけた条件を満たす場合には前記エアパージ手段を駆動することを特徴とする微粉炭吹込み方法。

3. 発明の詳細な説明

本発明は、高炉内へ羽口から吹込みノズルを用いて微粉炭を吹き込む方法において、その吹込みノズルが微粉炭により閉塞するのを防止する方法に関する。

昔て高炉で使用する燃料はコークスだけであつたが、高炉技術の発展により羽口から高炉内へ補助燃料として重油が吹き込まれるようになり、更に最近は、エネルギ事情を反映して羽口から吹き込まれる前記重油に替えて微粉炭を吹き込む方法が実用化されつつある。

この微粉炭を羽口から吹き込む方法として、羽口へ吹込みノズルを、その出口が羽口先端に位置するように取り付け、該吹込みノズルから微粉炭を吹き込むことが、行われるが、この方法を採用する場合は、微粉炭が熱せられて吹込みノズルの先端部分の内壁に付着することにより、吹込みノズルが閉塞し、その結果その閉塞した羽口からの微粉炭吹込み流量が低下し、各羽口からの微粉炭の吹込み量が均一でなくなるという事態が生じる。斯かる事態は高炉の安定操業を確保するために回避しなければならない。

斯かる事態を回避する場合、従来は、吹込みノズルに微粉炭を送給することを一旦停止し、それに替えて圧縮空気を送給することにより吹込みノズル内のパージを行うことが実施されているが、羽口前温度を一定に保つて微粉炭を吹き込みつつ、同時に吹込みノズル内のパージを行う方法は未だ開発されていない。

然るに前記吹込みノズルが閉塞状態となつた場

合、その羽口からの微粉炭流量が低下するのは前述の通りであるが、羽口前温度が上昇するという事実も経験的に知見した。第1図は羽口前温度と微粉炭流量との関係を示したグラフであるが、両者の間には一定の関係があることが分かる。

本発明は斯かる知見に基づいてなされたものであり、羽口前温度を計測することにより吹込みノズル内の微粉炭付着状態を検知し、これに基づいて吹込みノズルの閉塞を未然に防止し、微粉炭の高炉内への吹込みの安定化を図ることを目的とする。

本発明に係る微粉炭吹込み方法は、高炉内へ微粉炭を吹き込む方法において、微粉炭吹込み用ノズルにノズル内付着微粉炭のエアパージ手段を設けておく一方、羽口前温度を計測し、この計測結果がノズル内付着微粉炭量と関連づけた条件を満たす場合には前記エアパージ手段を駆動することを特徴とする。

以下本発明をその実施例を示す図面に基づいて詳述する。第2図は本発明方法に係る高炉羽口近傍の模式的断面図であり、第3図はその要部拡大図である。

1は高炉であつて鉄皮1aの内面にレンガ1bが内張りした構造となつており、内部に鉄鉱石、コークス、石灰石等が装入されて製鉄が行われる。該高炉1の周囲には熱風炉（図示せず）から導かれた熱風環状管（図示せず）が環状に配されており、更に該熱風環状管は送風支管3を経て高炉1の下部内面周囲に等配された羽口2へ夫々通じている。そして熱風炉にて高温に熱せられた空気が熱風環状管を経て羽口2から高炉1内へ周方向に均一に吹き込まれるようになつている。

送風支管3の羽口2を見通し得る部分（図においては送風支管3が屈曲した部分）には羽口前温度を計測すべく温度計4が取り付けられており、該温度計4による計測値に関する信号は制御器5へ入力される。

6は吹込みノズルであつて、その先端出口6aが羽口2の先端に位置するように各羽口2に夫々取り付けられており、該吹込みノズル6によつて送給されてきた微粉炭が、羽口2の先端において前述の如く吹き込まれる高温の空気と共に高炉1内へ吹き込まれる。

吹込みノズル6の先端部分の内壁には、熱せられた微粉炭Aが第3図に示す如く付着しやすいが、この微粉炭Aを圧縮空気にて吹き飛ばすエアパージ手段、即ちエジェクタ7がその先端出口7aを前記吹込みノズル6の先端部分に位置させて取り付けられている。そしてエジェクタ7の中途には電磁弁8が取り付けられており、該電磁弁8は前記制御器5の出力信号によつて開閉制御されるようになつている。即ち、制御器5は、前記温度計4による計測値と予め設定された基準値とを比較し、前者が後者より高い場合には前記電磁弁8を開き、また逆の場合には前記電磁弁8を閉じるように制御する。

羽口2近傍が上述の如く構成された高炉1内へ微粉炭を吹き込む場合、微粉炭が熱せられて吹込みノズル6の先端部分の内壁に付着すると、吹込みノズル6の先端部分が閉塞状態となることにより、微粉炭吹込み流量が低下する。そして微粉炭吹込流量が低下すると第1図において説明したように羽口前温度が上昇するので、その羽口前温度を温度計4にて計測することにより吹込みノズル6の閉塞状態を把握することができる。従つてその計測値に基づいて制御器5により電磁弁8を開閉制御し、前記吹込みノズル6が閉塞した場合には圧縮空気をエジェクタ7により吹込みノズル6の先端部分に吹き込んで前述の如く付着した微粉炭Aを吹き飛ばすことにより、吹込みノズル6内をエアパージすることができる。なお、本発明の如く羽口前温度を計測する方が、羽口からの微粉炭吹込み流量を計測するよりも容易であることはいうまでもない。

次に本発明方法の実施例について説明する。第4図は羽口前温度の変動を、本発明方法による場合（図中、破線にて示す）と従来法による場合（図中、実線にて示す）とを比較して示したグラフである。図より、本発明方法による場合は、従来法による場合に比して羽口前温度の変動が小さく、

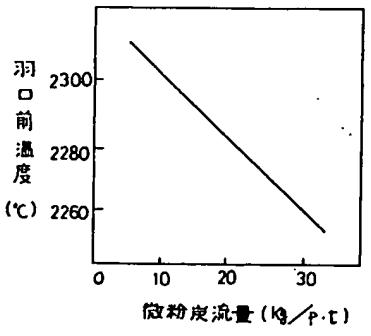
従つて羽口から高炉内へ吹き込まれる微粉炭流量の変動も小さく、本発明方法の優れた効果を確認することができた。

以上詳述した如く、本発明による場合は、高炉内へ微粉炭を吹き込む方法において、吹込ノズル内の微粉炭付着量を羽口前温度に基づいて検知し、それが所定量以上となつた場合には吹込みノズル内へ圧縮空気を吹き込むことによりエアパージすることとしているので、吹込みノズルの閉塞を未然に防止し、羽口からの微粉炭吹込み量の均一化を図ることができる。従つて本発明は高炉の安定操業の実現に寄与する有力な手段を提供するものである。

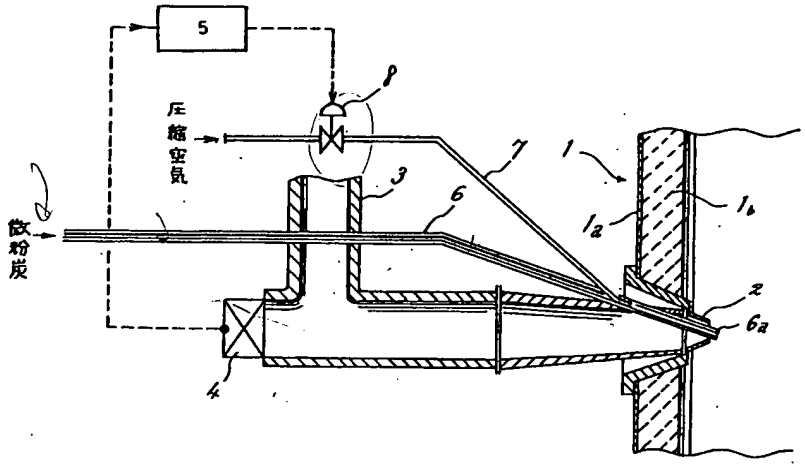
4. 図面の簡単な説明

第1図は羽口前温度と微粉炭温度との関係を示すグラフ、第2図は本発明方法に係る高炉羽口近傍の模式的断面図、第3図はその要部拡大図、第4図は本発明方法の効果を示すグラフである。

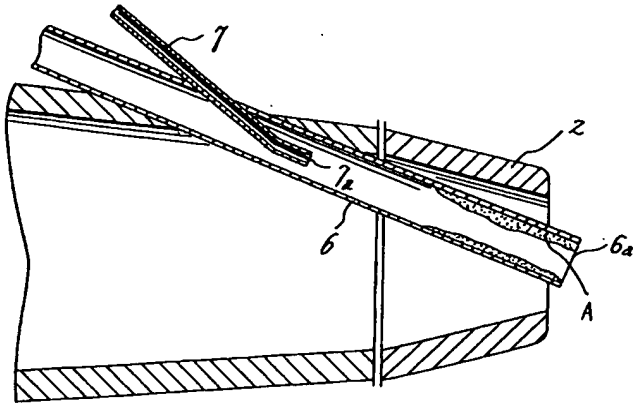
1…高炉　2…羽口　4…温度計　6…吹込みノズル　7…エジェクタ



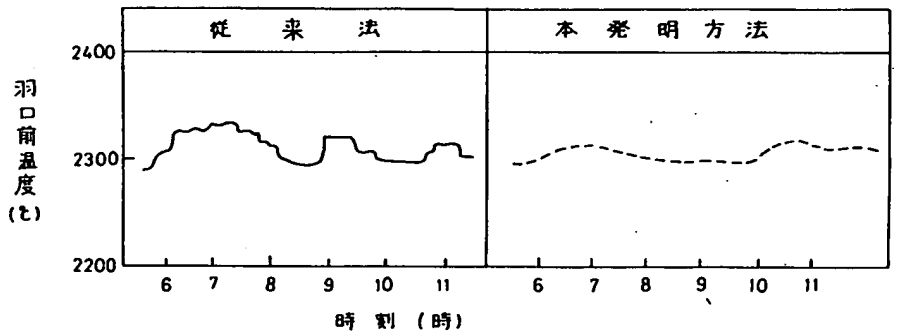
第 1 図



第 2 図


7
2
7a
6
6a
A

第 3 図


従 来 法
本 発 明 方 法
2400
2300
2200
羽口前温度 (℃)
6 7 8 9 10 11
6 7 8 9 10 11
時 刻 (時)

第 4 図